Francis R. Scobee

Launch Vehicle Design Challenge

COMMANDER

A U.S. Air Force pilot and aerospace engineer, Scobee was known for his dedication to aviation and leadership. He previously piloted a shuttle mission and was passionate about flight.

OBJECTIVE

Build a straw or paper rocket that travels the furthest or most accurately.

STUDENTS WILL:

1. Review Scobee's role as a pilot and engineer.
2. Discuss key rocket parts and how launch angle affects trajectory.
3. Build rockets and test launches.
4. Record data and redesign for improvement.

MATERIALS

- Straws, paper, scissors, tape
- Rulers, protractors, launch area
- Targets or measuring tape
- Rocket Design Student Worksheet

STEP BY STEP INSTRUCTIONS

1. **Introduction:** Share background on Scobee and his experience as a pilot and aerospace engineer.
    b. On board the Challenger, one of his NASA assigned mission goals was to deploy a communications satellite that would be used to study Hailey's Comet.
    c. See Biographical Data Sheet for his work experience with NASA
    a. Notable works of Scobee:
        i. Before joining NASA he was a combat pilot in Vietnam flying over 160 missions.
        ii. Once joining NASA he worked with experimental aircrafts and complex flight control systems. His work led to great developments helping to make airplanes safer and more efficient.

STEP BY STEP INSTRUCTIONS (continued)

2. **Mini-Lesson on Rockets:**
    a. What are the parts of a rocket?
        i. **Nose Cone –** located at the top of the rocket. Its purpose is to help the rocket move through the air easier.
        ii. **Body –** located in the middle of the rocket. Its purpose is to house all of the fuel needed for the flight. This section of the rocket is the largest.
        iii. **Fins –** located at the base of the rocket. Their purpose is to keep the rocket on a straight path (similar to the feathers on an arrow).
        iv. **Engines –** located at the base of the rocket. Their purpose is to provide power to make the rocket move.
        v. **Payload Area –** located near the top of the rocket right after the nose cone. Its purpose is to carry any cargo for the flight. The cargo may include people, satellites, rovers, experiments, food, etc.
    b. How does the launch angle, weight, and balance affect flight?
        i. The angle of the rocket during launch affects its flight path.
        ii. The weight of the rocket has to be in proportion to the amount of fuel onboard. The lighter the rocket the less fuel is needed to power the rocket. The heavier the rocket the more fuel is needed to power the rocket.
        iii. If a rocket is not balanced it could cause the rocket to spin out of control or tip over. Weight must be distributed evenly to ensure a safe and straight flight.
3. **Set Constraints:** Students will build rockets using straws or rolled paper, tape, fins, and optional nose cones.
    a. Explain to students that they will be building and launching a rocket. Share with them which supplies will be available for them to use. Also, explain how you plan on launching these rockets (straw, air launcher, etc.)
4. **Design Phase:** Allow time for students to complete the front of the Rocket Design Student Worksheet.
5. **Build:** Construct the rockets based on the students' plans.
6. **Test Launches:**
    a. Have students make predictions about the distance their rocket will travel. Have students record their predictions and why they believe this to be true on the back of the Rocket Design Student Worksheet.
    b. Use a straw or air launcher to launch. Record the distance traveled on the "Test 1 Distance" area on the Rocket Design Student Worksheet.
7. **Redesign:** Reflect on performance, adjust designs.
    a. Complete the question on the Rocket Design Student Worksheet explaining what changes you made to your rocket.
8. **Final Launch and Compare:** Run a final test and compare data.
    a. Record distance of the new version of your rocket on "Test 2" distance on the Rocket Design Student Worksheet.
9. **Reflection:** Students write about what variables made a difference in their rocket's success. Record answers on the last question on the Rocket Design Student Worksheet.
10. **Optional Extension:** Create a slow-motion video analysis or a launch simulation in a program like Tinkercad or PhET.

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Rocket Design Student Worksheet

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A U.S. Air Force pilot and aerospace engineer, Scobee was known for his dedication to aviation and leadership. He previously piloted a shuttle mission and was passionate about flight.

Sketch your rocket design and label the parts:
[Nose cone, fins, body, launch angle]

Predict how your rocket will perform:

Distance: _____ Accuracy: _____

Why?

_____

_____

_____

_____

Launch Data:

Test 1 Distance: _____ Test 2 Distance: _____ Accuracy Score: _____

What change did you make to improve the design?

_____

_____

_____

_____

Final Reflection: What did you learn about flight or rocket design?

_____

_____

_____

_____